PAMS Technical Documentation
NSM–5 Series Transceivers

UI section

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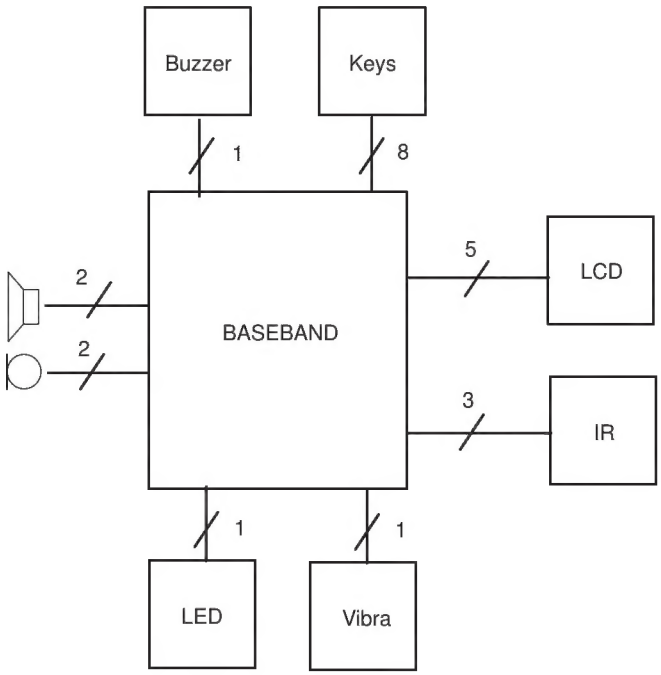
UI section

Introduction

UI module is implemented on same PWB board with BB–module and RF–module. UI HW part are LCD, backlighting, audio parts, IR, keyboard, power key and vibra.



BB Interface

Signal	Parameter	Min	Typ	Max	Unit	Notes
IRONX	IR–module on/off	0 0.7 x VBB		0.3 x VBB VBB	V	IR on state Iout@2mA
FBUS_RX	IR receive pulse	0		0.3 x VBB		
	IR receive no pulse	0.7 x VBB		VBB		
FBUS_TX	IR transmit pulse	0.7 x VBB		VBB		Iout@2mA
	IR transmit no pulse	0		03 x VBB		
VIBRA	From VB	0.9	1.0	1.1	V	
			115	140	mA	
ROW (0:4)	Rows	0 0.7 x VBB		0.3 x VBB VBB	V	Keyboard matrix row
COL (0:4)	COL0	0 0.7 x VBB		0.3 x VBB VBB		Keyboard matrix column
VB	Battery voltage	3.0		4.8		Battery voltage (for lights)

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Signal	Parameter	Min	Typ	Max	Unit	Notes
PWRONX	Power on signal	0 0.7 x VBB		0.3 x VBB VBB	V	Power on key
ROW5/ LCDCD	LCD command / data	0 0.7 x VBB		0.3 x VBB VBB		Keyboard matrix row 5 LCD driver code/ data selection
SCL	Serial clock for LCD	0 0.7 x VBB		0.3 x VBB VBB		LCD driver serial clock
SDA	Serial data for LCD	0 0.7 x VBB		0.3 x VBB VBB		LCD driver serial data
LCDEN	LCD enable	0 0.7 x VBB		0.3 x VBB VBB		LCD driver chip select
LCDRSTX	Reset	0 0.7 x VBB		0.3 x VBB VBB		LCD driver reset
GND		0		0		Ground
BUZZER		0		0.3 x VBB		PWM low level
		0.7 x VBB		VBB		PWM high level
		440		4700	Hz	Buzzer PWM frequency
		0		50	%	PWM duty cycle
VBB		2.7	2.8	2.9	V	Logic supply voltage
LIGHT		0 0.7 x VBB		0.3 x VBB VBB		Illumination control
EARN			17.6	788	mV	Connected to COBBA EARN output.
EARP			17.6	788	mV	Connected to COBBA EARP output.
CCUT	Charging control	0 0.7 x VBB		0.3 x VBB VBB		Stops charging

LCD Module Interface

Pin	Line Symbol	Parameter	Minimum	Typical / Nominal	Maximum	Unit	Notes
1	VBB	Supply voltage	2.7	2.8	2.9	V	
					300	uA	
2	SCLK	Serial clock input	0		4.0	MHz	VBB = 2.7V
			0		VBB	V	
3	SDA	Serial data input	0 0.7xVBB		0.3xVBB VBB		

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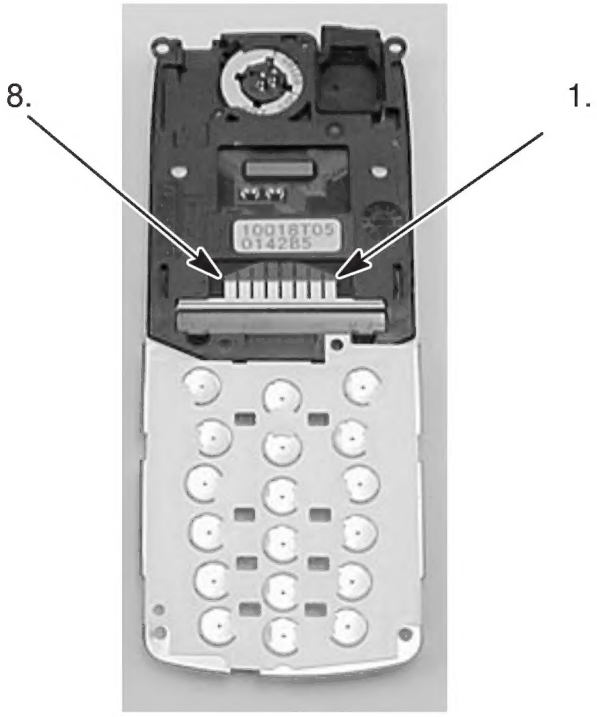
Pin	Line Symbol	Parameter	Mini-mum	Typical / Nomi-nal	Maxi-mum	Unit	Notes
4	LCDCDX	Control/display data flag input	0 0.7xVBB		0.3xVBB VBB		Control Data
5	LCDCSX	Chip select input	0 0.7xVBB		0.3xVBB VBB		Active
6	GND	Ground		0		V	
7	VOUT	DC/DC voltage con-verter output			9		
8	LCDRSTX	Reset	0 0.7xVBB		0.3xVBB VBB		Active

LCD Module Interface numbering order:



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Bottom Connector signals

Name	Min	Typ	Max	Unit	Notes
XMICP, XMICN		*2.2*		kΩ	Input AC impedance
			1	Vpp	Maximum signal level
	1.47		*1.55*	V	Mute (output DC level)
	2.5		*2.9*	V	Unmute (output DC level)
	100		*600*	µA	Bias current
		60	*350*	mV	Maximum signal level
XEARP, XEARN		*47*		Ω	Output AC impedance (ref. GND)
		10		µF	Series output capacitance
	16		*300*	Ω	Load AC impedance to GND (Headset)
		6.8		kΩ	Load AC impedance to GND (Accessory)
			1.0	Vpp	Maximum output level (no load)
		22	*626*	mV	Output signal level
		10		kΩ	Load DC resistance to GND (Accessory)
	16		*1500*	Ω	Load DC resistance to GND (Headset)
		2.8		V	DC voltage (100k pull–up to VBB)
HEADDET		*21*		uA	When accessory is not connected

An external headset device is connected to the system connector XMIC and XEAR lines, from which the signals are routed to COBBA MIC3 microphone inputs and HF earphone outputs.

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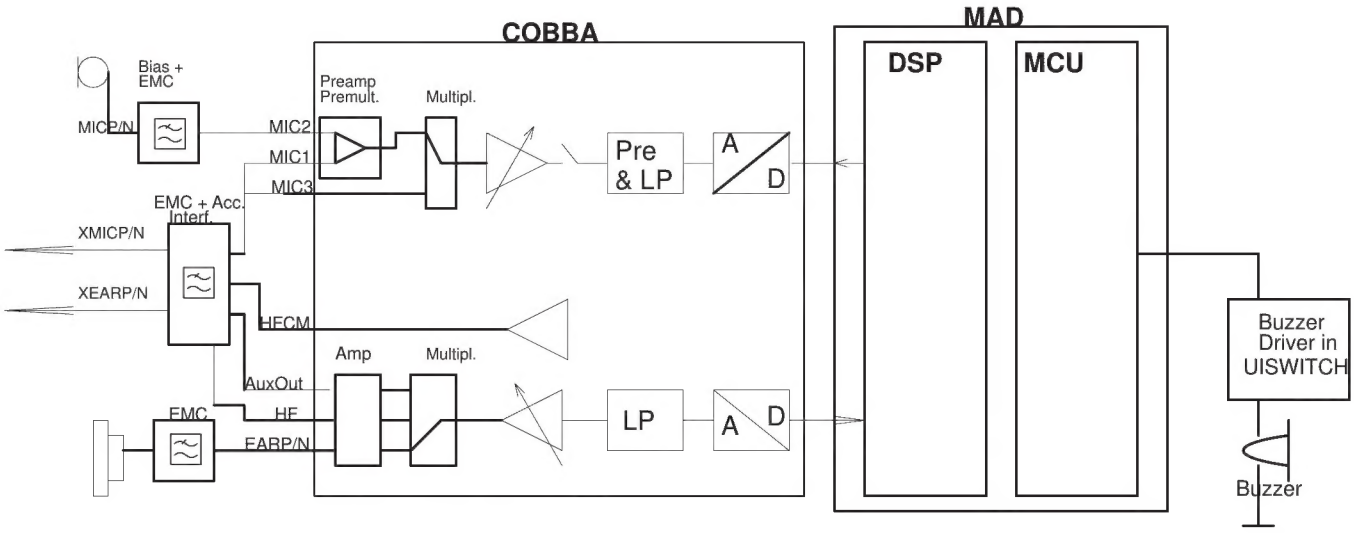
Functional Description

Audio control

The audio control and processing is taken care by the COBBA–GJP, which contains the audio (and RF codecs, and the MAD2, which contains the MCU, ASIC and DSP blocks handling and processing the audio signals.



The baseband supports three microphone inputs and two earphone outputs. The inputs can be taken from an internal microphone, a headset microphone or PPH–1 microphones. The microphone signals from different sources are connected to separate inputs at the COBBA–GJP ASIC. Inputs for the microphone signals are differential type.

The MIC1 inputs are used for a headset microphone that can be connected directly to the HS/HF connector. The internal microphone is connected to MIC2 inputs. In COBBA there are also three audio signal outputs of which dual ended EAR lines are used for internal earpiece and HF line for accessory audio output. The third audio output AUXOUT is used for bias supply to the headset microphone. PData(2) is used for PPH–1 mute control.

The output for the internal earphone is a dual ended type output capable of driving a dynamic type speaker. The output for the external accessory and the headset is dual ended (differential). Input and output signal source selection and gain control is performed inside the COBBA–GJP asic according to control messages from the MAD2. Keypad tones, DTMF, and other audio tones are generated and encoded by the MAD2 and transmitted to the COBBA–GJP for decoding.

External audio connections

The external audio connections are presented on the next page. A headset and PPH–1 can be connected directly to the system connector. The headset microphone bias is supplied from COBBA AUXOUT output and fed to microphone through XMICP line.

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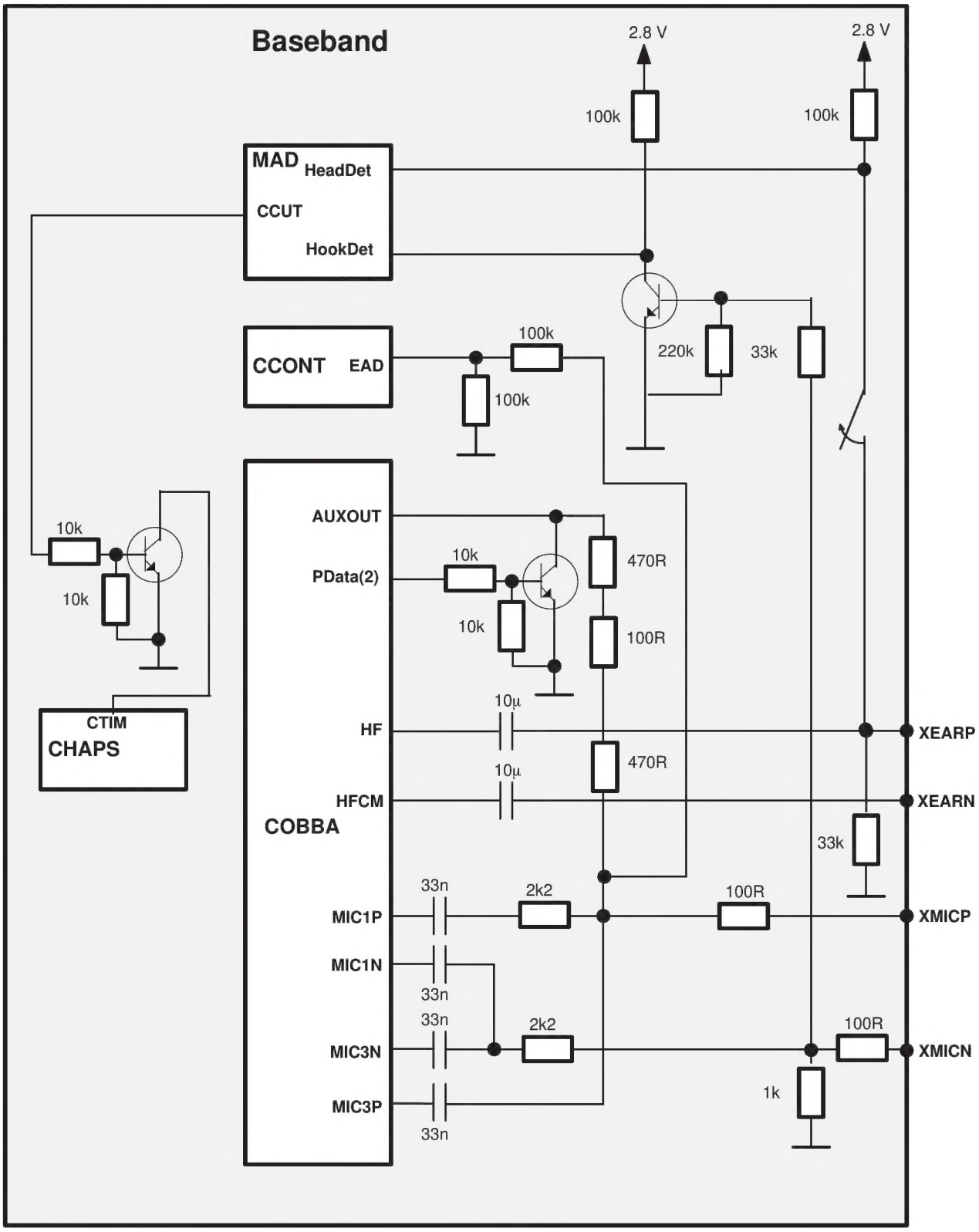

Analog audio accessory detection

In XEARP signal there is a 100 kΩ pullup and 33k pulldown in the transceiver for HeadDet. The HeadDet is pulled up when an accessory is connected, and pulled down when disconnected. To get HeadDet work properly the system connector must be assembled otherwise the transceiver

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will assume that some accessory is connected. In XMICN signal there is a 1.2 kΩ pulldown in transceiver and serial 1.2 kΩ from AUXOUT to XMICP. The XMICN is connected to transistor which is then connected to the HookDet line (in MAD).

External accessory notices powered–up phone by detecting voltage in HeadDet line.

Accessory connected	HookDet*)	HeadDet**)	Notes
No accessory connected	High	Low	
Headset with a button switch pressed	Low	High	XEAR and XMIC loaded (dc)
Headset with a button switch released	High	High	XEAR and XMIC loaded (dc)
Handsfree (PPH–1)	Low	High	XMIC loaded (dc)

**) HookDet is used only for detect button in headset*

***) HeadDet is used only for detect that some accessory is connected into system connector*

NOTE: Charging must stop when the detection sequences is done! CCUT signal at high stops charging.

Headset detection

The external headset device is connected to the headset connector, from which the signals are routed to COBBA headset microphone inputs and earphone outputs. In the XMICN line there is a 1.0 kΩ pulldown in the transceiver. The microphone is a low resistance pullup compared to the transceiver pulldown.

When there is no call going, the AUXOUT is in high impedance state and the XMICN and XMICP is pulled down. When a headset is connected, the XMICP is pulled up. The switch inside the system connector is connected to the HeadDet line (in MAD), an interrupt is given due to both connection and disconnection.

NOTE: If the headset is connected switch closed the transceiver can not detect if headset or PPH–1 in power off mode is connected. When switch is released to open transceiver can not any more detect the headset without polling by SW.

Headset switch detection

In the XMICN line there is a 1.0 kΩ pulldown in the transceiver. The microphone is a low resistance pullup compared to the transceiver pulldown. When a remote control switch is open, there is a capacitor in parallel with the microphone, so the XMICN is pulled up and HookDet pulled down by the phone, when AUXOUT is set to 2.1V. When the switch is closed, the XMICN is pulled down via the microphone and HookDet is pulled up. So both press and release of the button gives an interrupt when AUXOUT is set to 2.1V.

PPH–1 detection

The external Plug & Play PPH–1 device is connected to the system connector, from which the signals are routed to COBBA headset microphone

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inputs and earphone outputs. In the XMICN line there is a 1.0 kΩ pull-down in the transceiver. The PPH–1 has a low resistance pullup compared to the transceiver pulldown. When there is no call going, the AUXOUT is in high impedance state and the XMICN and XMICP is pulled down. When a powered PPH–1 is connected, the XMICP is pulled up. The switch inside the system connector is connected to the HeadDet line (in MAD), an interrupt is given due to both connection and disconnection.

In PPH–1 device has two operating mode device with external microphone and without external microphone. When internal microphone is used the detection signal (EAD) is higher than when external microphone is used.

NOTE I: If the PPH–1 is connected power off mode the transceiver can not detect if device is a headset or a PPH–1 connected. When PPH–1 is powered on it is possible to detect when case of PPH–1.

NOTE II: If the external microphone is connected from or disconnected to PPH–1 it is not possible for transceiver to detect when that happens.

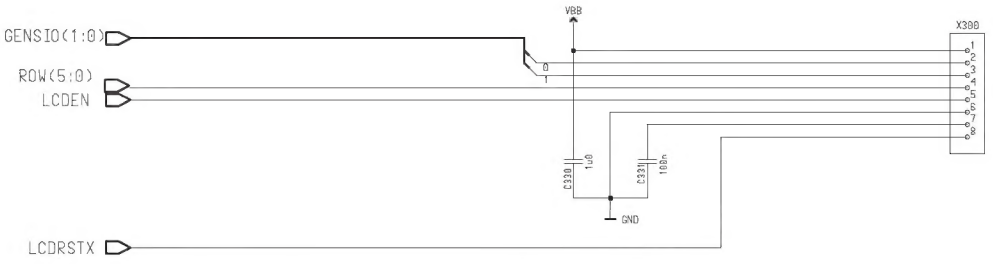
Internal audio connections

The speech coding functions are performed by the DSP in the MAD2 and the coded speech blocks are transferred to the COBBA for digital to analog conversion, down link direction. In the up link direction the PCM coded speech blocks are read from the COBBA by the DSP.

Display Circuit

The display circuit includes LCD module UX7 and two capacitors. The LCD module is COG (Chip on Glass) technology. The connection method for chip on the glass is ACF, Adhesive Conductive Film. The LCD module is connected to UI board with connector. Capacitors are placed on PWB.

The display driver includes hw–reset, voltage tripler or quadrupler which depends on temperature, temperature compensating circuit and low power control. Driver includes 84x48 RAM memory which is used when some elements are create on display. Elements can be created with software. Driver doesn't include CG–ROM. One bit in RAM is same as one pixel on display.



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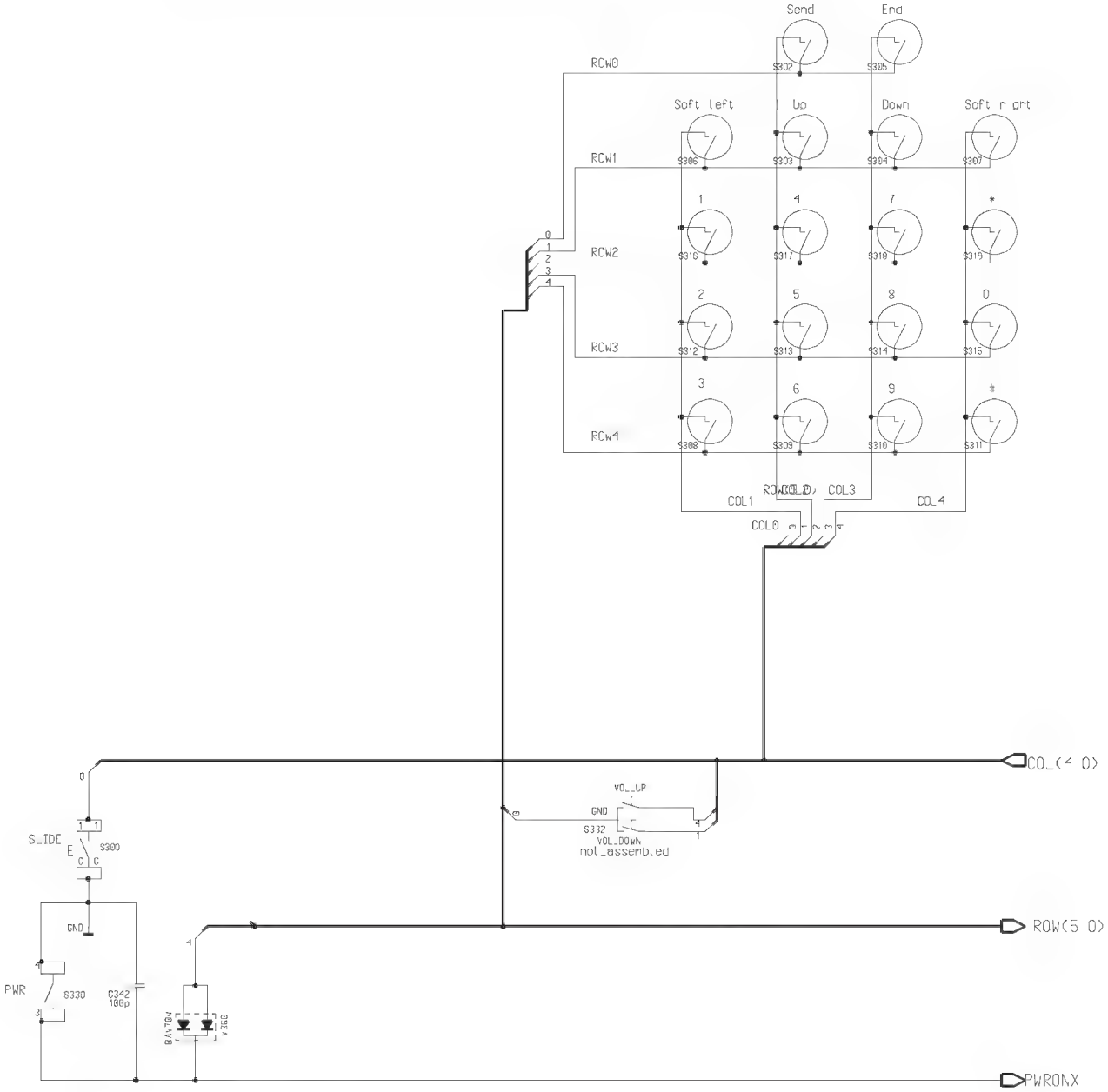
Keyboard

Matrix size is 5 row and 5 columns. Scanning is used for keyboard reading. Rows and columns is connected to MAD interface.



Keyboard Matrix

ROW/COL	0	1	2	3	4
0	SLIDE SWT	Side Key	Send	End/Mode	Side Key
1	NC	Soft left	Up	Down	Soft Right
2	NC	1	4	7	*
3	NC	2	5	8	0
4	PWR switch	3	6	9	#

NC = Not Connected

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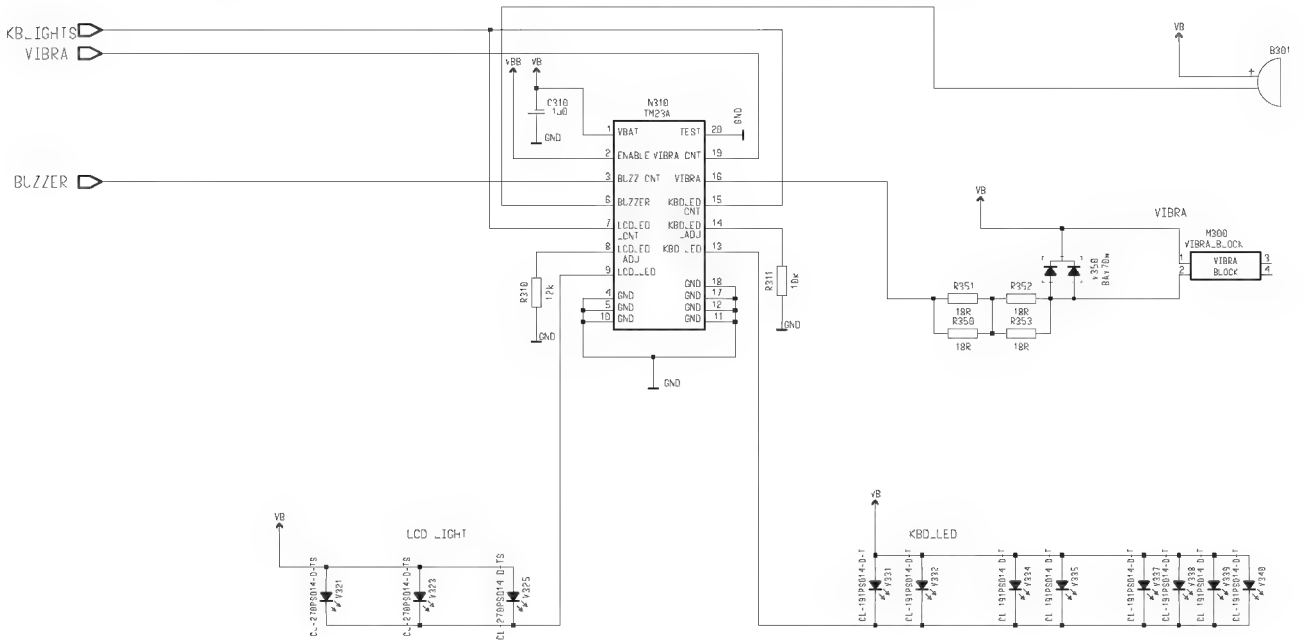
Power Key

Micro switch is used as a power key on UI module. Circuitry includes micro switch and two diodes which is needed for MAD interface. Power key is connected to CCONT. Power switch is active in LOW state. Power key is connected to ROW4.

Backlighting

Switching circuits for backlighting are placed on UI module. Display and keyboard lighting is connected together. When LIGHT–signal is HIGH the lights are on and when LIGHT–signal is LOW state lights are off.



Backlighting is made by LEDs, three LEDs on the bottom of the display. Light is on when LIGHT–signal is in HIGH state.

In keyboard backlighting is made by 8 LEDs. Backlighting is on when LIGHT–signal is on HIGH state.

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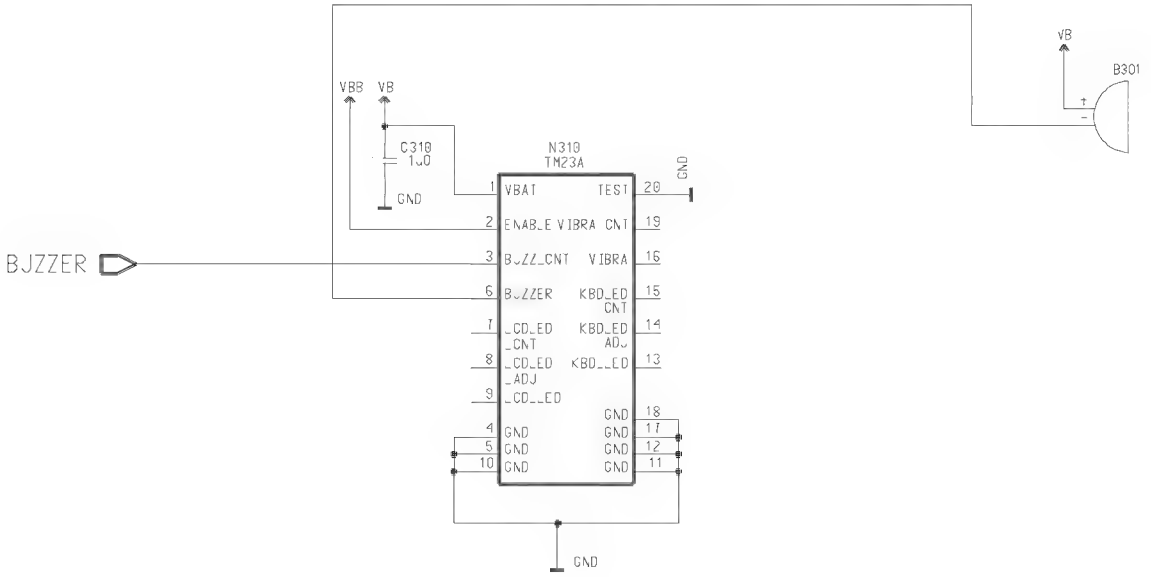
Buzzer

Alerting tones and/or melodies as a signal of an incoming call are generated with a buzzer that is controlled with a PWM signal by the MAD via UISWITCH. Also keypress and user function response beeps are generated with the buzzer. The buzzer is a SMD device and is placed on the mother board. Target for SPL is 100dB (A) at 5cm.



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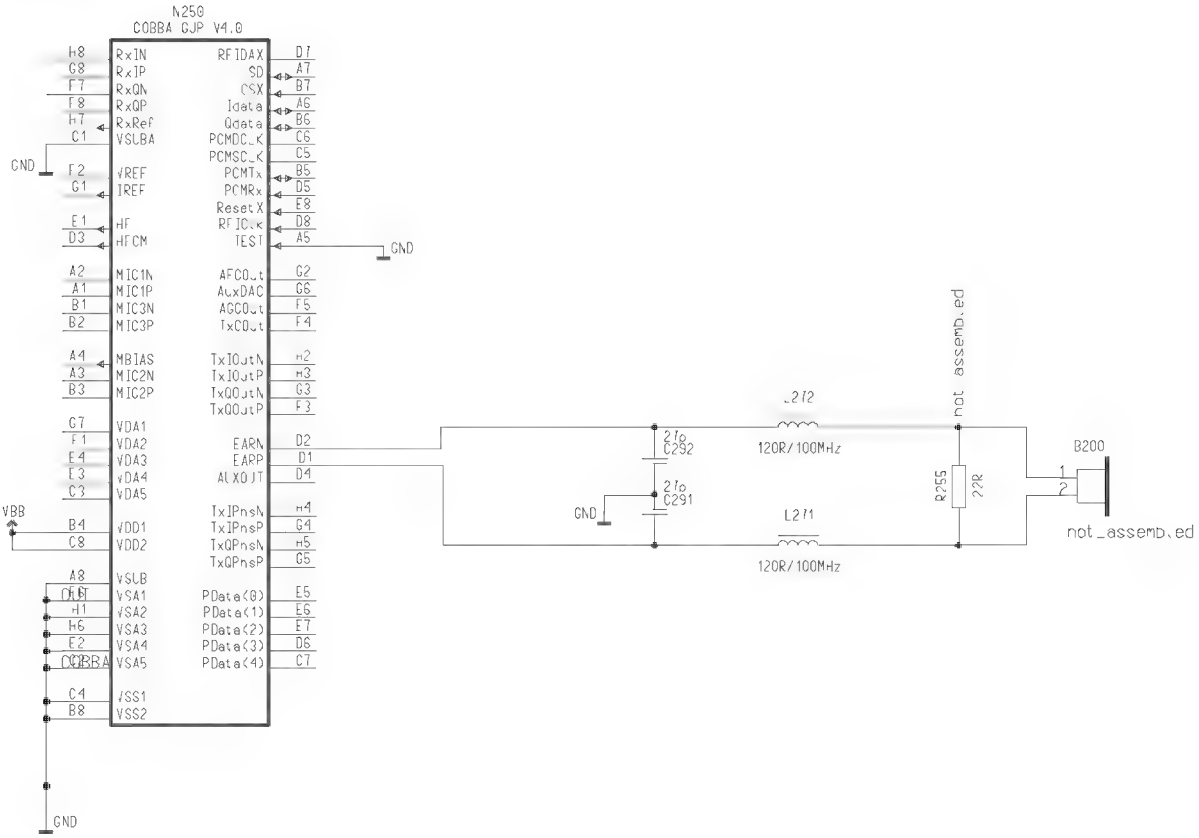
Speaker

Speaker circuit includes pads for speaker and 2 capacitors, 2 ferrites for EMC protection.

Speaker is sealed to A–cover with gasket and UI PWB with supporting ring. With that the frequency response is more constant. Speaker does not need holes for PWB. This gives reliable sound quality for the phone and it can be estimated in several environments. Arrangement is not a leak tolerant speaker.

The low impedance, dynamic type earphone is connected to a differential output in the COBBA audio codec. The electrical specifications for the earphone output are shown below. The voltage level at each output is given as reference to ground. Earphone levels are given to 32 ohm load.

	Nominal	Maximum	Notes
COBBA output, differential, 6dB gain	17.6mV	788mV	ENGINE – UI Interface; Estimate, must be checked with final earpiece construction
Earpiece sound pressure (sensitivity +28dBPa/V 1kHz)	–7dBPa	+26dBPa	Measured as shielded (in brackets with leak ring)



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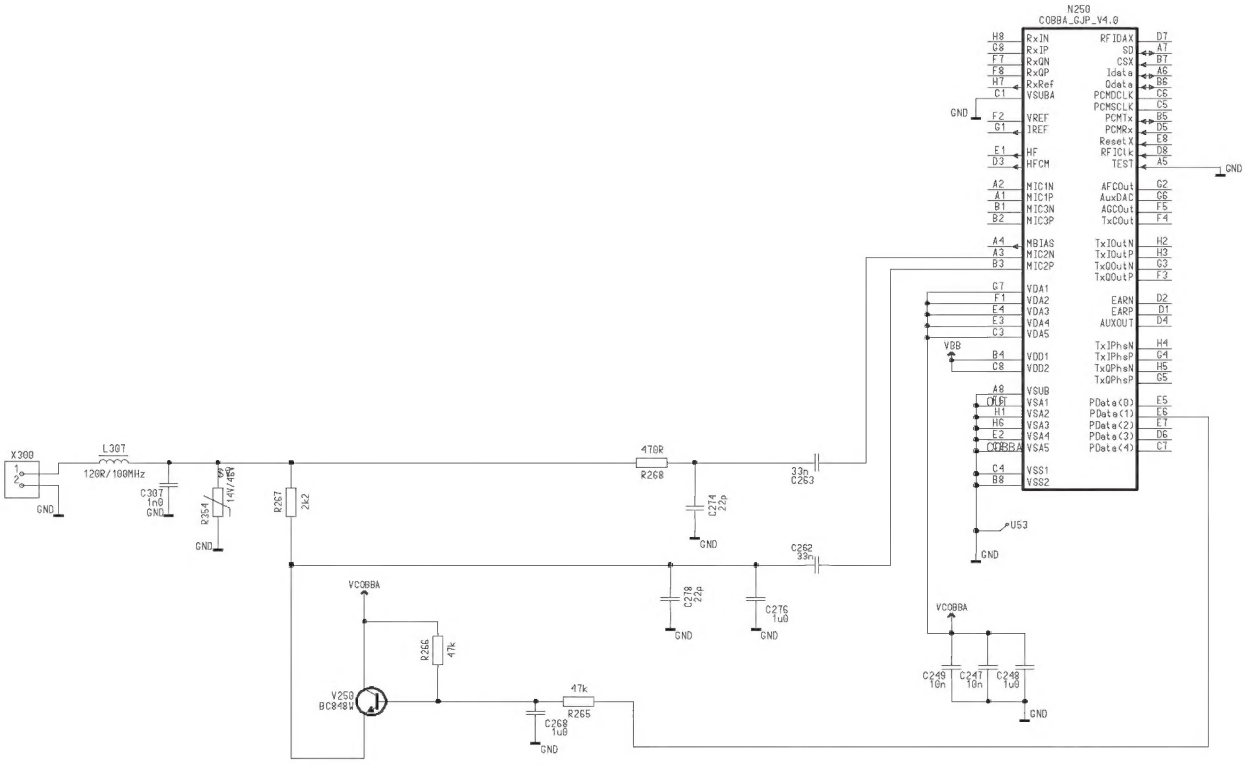
Microphone

The internal microphone is placed to slide. Microphone is OMNI directional. The microphone requires a bias current to operate. The bias current is generated from VCOBBA supply with a transistor. EMC protection parts are implemented partly in slide and partly on motherboard.

Pin	Name	Min	Typ	Max	Unit	Notes
X300/2	MICP		0.55	4.1	mV	Connected to COBBA MIC2N input. The maximum value corresponds to1 kHz, 0 dBmO network level with input amplifier gain set to 32 dB. typical value is maximum value – 16 dB.
X300/1	MICN		0.55	4.1	mV	Connected to COBBA MIC2P input. The maximum value corresponds to1 kHz, 0 dBmO network level with input amplifier gain set to 32 dB. typical value is maximum value – 16 dB.



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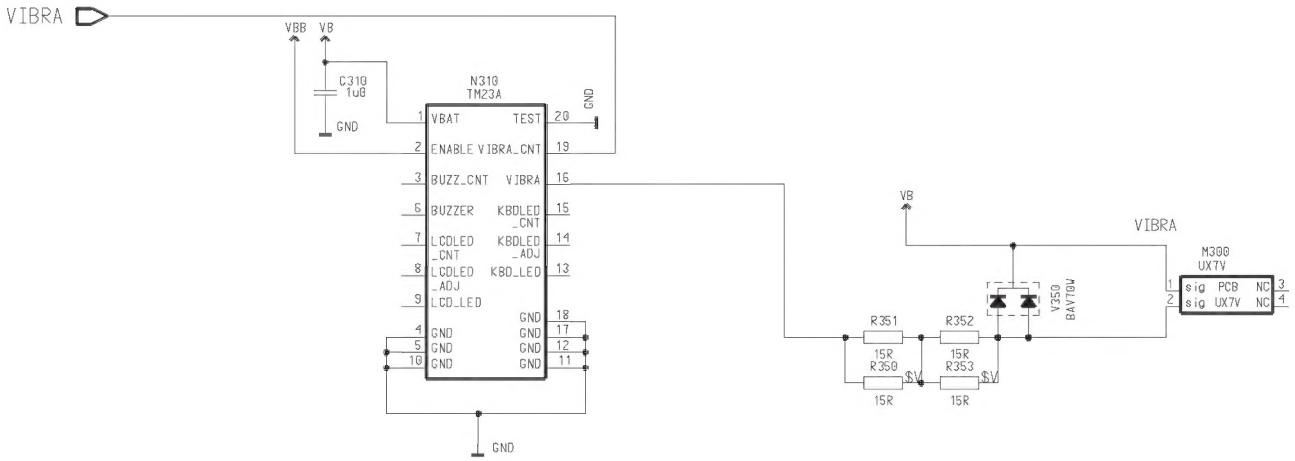
Vibra Alerting Device

A vibra alerting device is used for giving silent signal to the user of an incoming call. Vibra is located in the phone. The vibra is controlled with a PWM signal by the MAD via UISWITCH.

Signal	Parameter	Min	Typ	Max	Unit	Notes
M300 / 1		1.0	1.1	2.0	V	Measured against M300/2
I_{vibra}	Rated load current		115	140	mA	
	Rated load speed	7000	8000	12000	rpm	



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IR Module

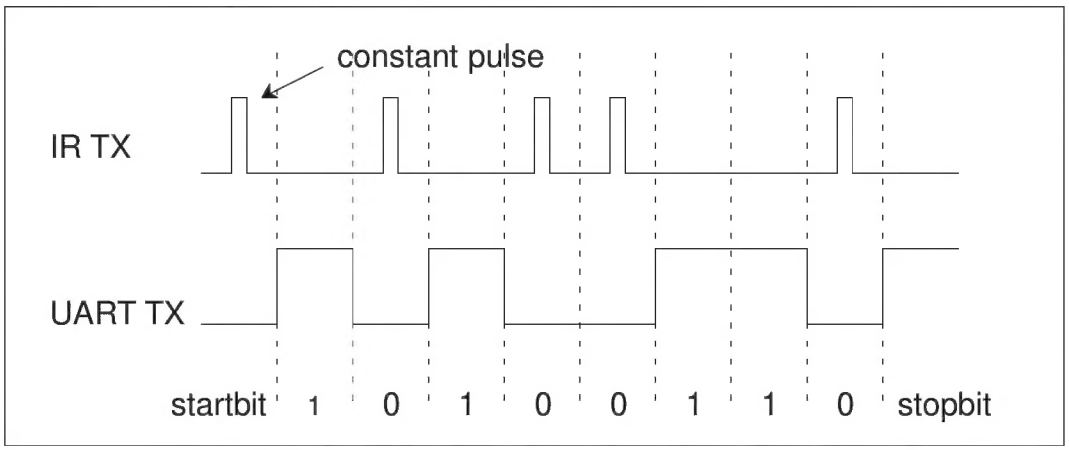
An infrared transceiver module is designed to substitute an electrical cable between the phone and a PC. The infrared transceiver module is a stand alone component capable to perform infrared transmitting and receiving functions by transforming signals transmitted in infrared light from and to electrical data pulses running in two wire asynchronous databus. IR is located left bottom corner of the product.

Signal	Parameter	Min	Typ	Max	Unit	Notes
IRONX	IR–module on/off	0.7 x VBB		VBB	V	Iout@2mA, IR is at off state
		0		0.3 x VBB		IR, is at on state
FBUS_RX	IR receive no pulse	0.7 x VBB		VBB		
	IR receive pulse	0		0.3 x VBB		
FBUS_TX	IR transmit pulse	0.7 x VBB		VBB		Iout@2mA
	IR transmit no pulse	0		0.3 x VBB		

The module is activated with an IRONX signal by the MAD, which supplies power to the module. The IR datalines are connected to the MAD accessory interface AccIf via FBUS. The AccIf in MAD performs pulse encoding and shaping for transmitted data and detection and decoding for received data pulses.

The data is transferred over the IR link using serial data at speeds 9.6, 19.2, 38.4, 57.6 or 115.2 kbits/s, which leads to maximum throughput of 92.160 kbits/s. The used IR module does not comply with the IrDA 1.0 specification (Infra Red Data Association), which is based on the HP SIR (Hewlett–Packard's Serial Infra Red) concept. Maximum transmission distance is set to 60cm.

In IR transmission a light pulse corresponds to 0–bit and a "dark pulse" corresponds to 1–bit.



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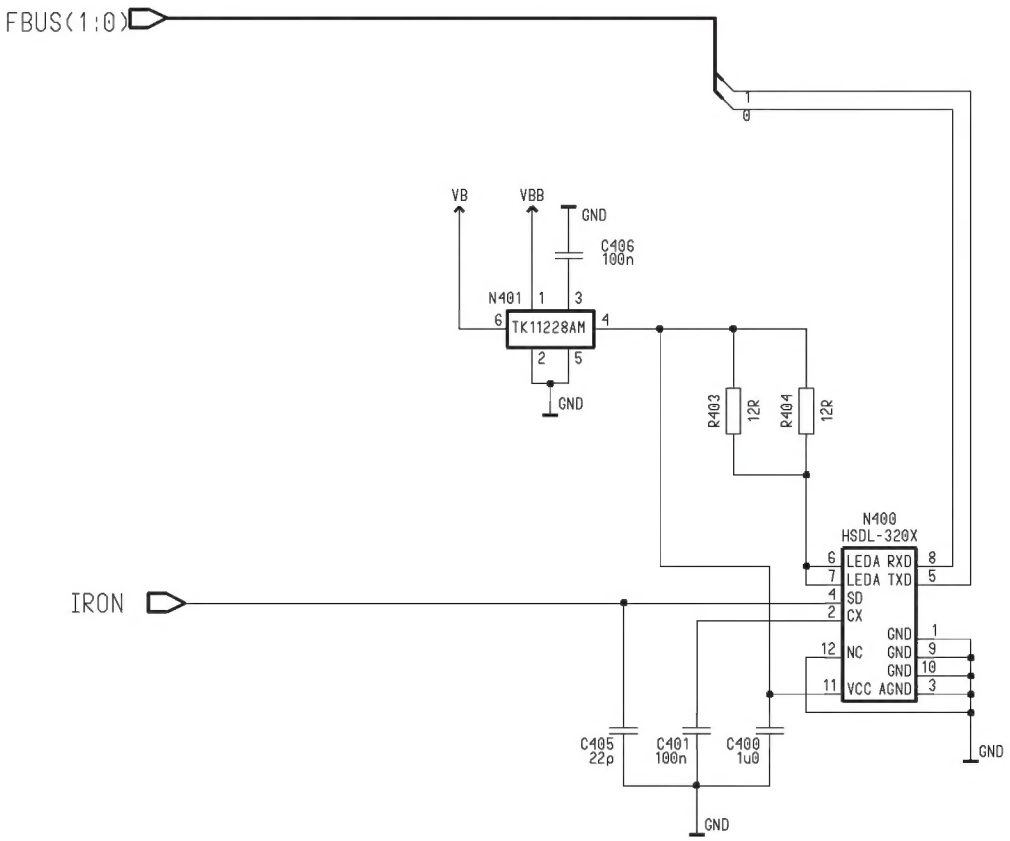
The FBUS cannot be used for external accessory communication, when the infrared mode is selected. Infrared communication reserves the FBUS completely.



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